Salt contamination of soil and groundwater within a shopping center area

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A new shopping center has been established during the last decade in the southern periphery of Malmö (the Svågertorp area) in southern Sweden. Some contractors have used municipal solid waste bottom ash (MSWBA) as an alternative aggregate material to build roads and parking places within the area. Total 40 000 tones of MSWBA from Sysav waste incineration plant in Malmö have been used as unbound subbase material. The bottom ash was place on a subgrade of clayey moraine.

A groundwater control program demanded by the Environment Department, City of Malmö, indicated increased salt (chloride and sulfate) concentrations in ground waters collected from several pipes installed in the clayey moraine soil. The Environment department denounced the need to investigate the cause for these changes. Such an investigation was initiated by Sysav and funded by professional organizations (Svenska EnergiAskor AB and Avfall Sverige) and waste companies (Sysav Utveckling AB, Renova and Fortum).

The overall objective of this study was to evaluate the importance of different emission sources and to describe the mechanisms controlling salt emissions in the area. Road salt and MSW BA were assumed to be important salt emissions sources.

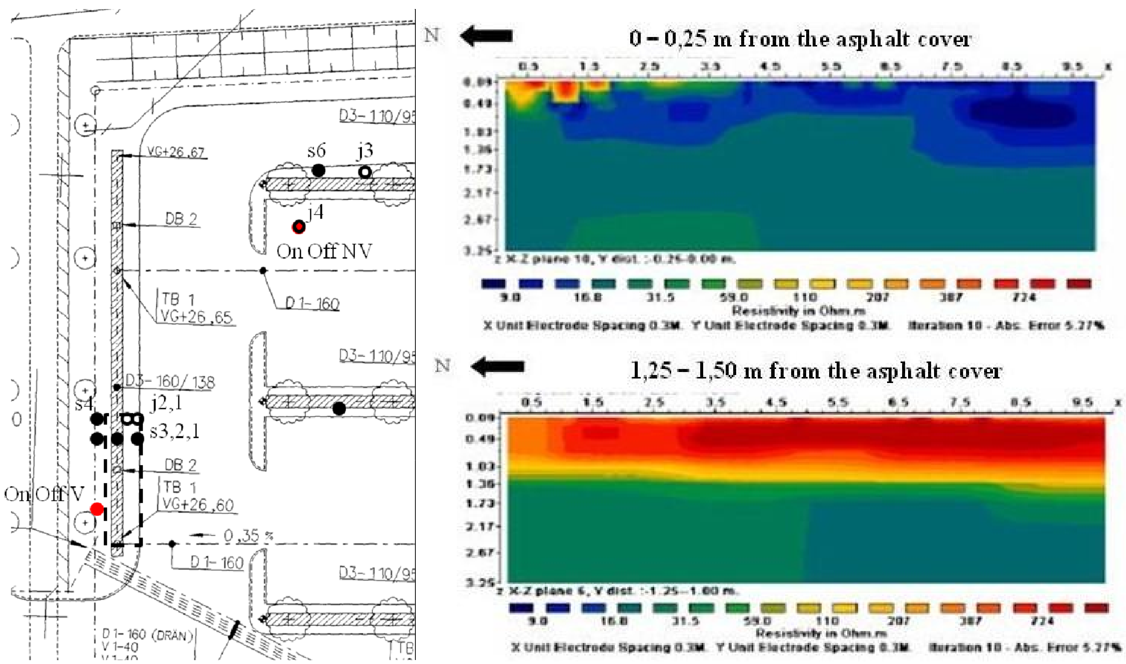
The green strips surrounding areas covered with asphalt (roads and parking places) were assumed to act as transfer routs for salts into the subgrade and ground waters.

Electrical resistivity imaging was used to

- investigate the soil structure in the green strips
- indentify salt emission

An ABEM Lund Imaging System was used. Surveys were performed along parallel lines 0.5 m apart with 0.5 m electrode spacing to improve the resolution close to the surface. A dipole-dipole array was used to improve the vertical resolution. Each line was 10 m long. The results were used to create 3-dimensional models of the electrical properties of the soil by inverse modeling using the software Res3dinV.

A small investigation area in a green strip adjacent to a parking place was used in this study. The parking place is covered with asphalt. The area, called On Off V is bounded by a dotted line in the technical drawing below. The investigation area should contain a detention trench according to the drawing.



Results

A resistivity survey carried out in an adjacent area (Bjulemar and Roupe, 1996) implies a relatively low resistivity, approaching 50 q m, in the clayey moraine soil within the investigation area. The presence of the detention trench is verified by a layer of much higher resistivity (lower profile to the right). Another layer of high resistivity can be found close to the surface just outside the asphalt cover (upper profile to the right). This layer is assumed to be the base and/or subbase layer of the parking place superstructure. However, close to surface there is also a zone of low resistivity (< 15 q m) which extends down into the saturated zone. The water pressure level observed in pipe ON Off V (red dot) varied between 1.2 and 1.6 m beneath the surface. The zone of low resistivity close to the surface seems to coincide with elevated concentrations of chloride. The chloride concentration in waters collected from pipe On Off V has increased gradually during seven years.

Conclusions

The infiltration of storm water, at times contaminate by road salts (NaCl), and the release of chlorides from bottom ash by leaching could add chlorides to the soil in the strip area. The concentration of chloride in water from the observation pipe On Off V is also affected by subsurface transports in the strip area.